CIAT

International Center for Tropical Agriculture
Since 1967 / Science to cultivate change

WAXY CASSAVA AGREEMENTS AT CIAT

25 June 2015
Cali, Colombia

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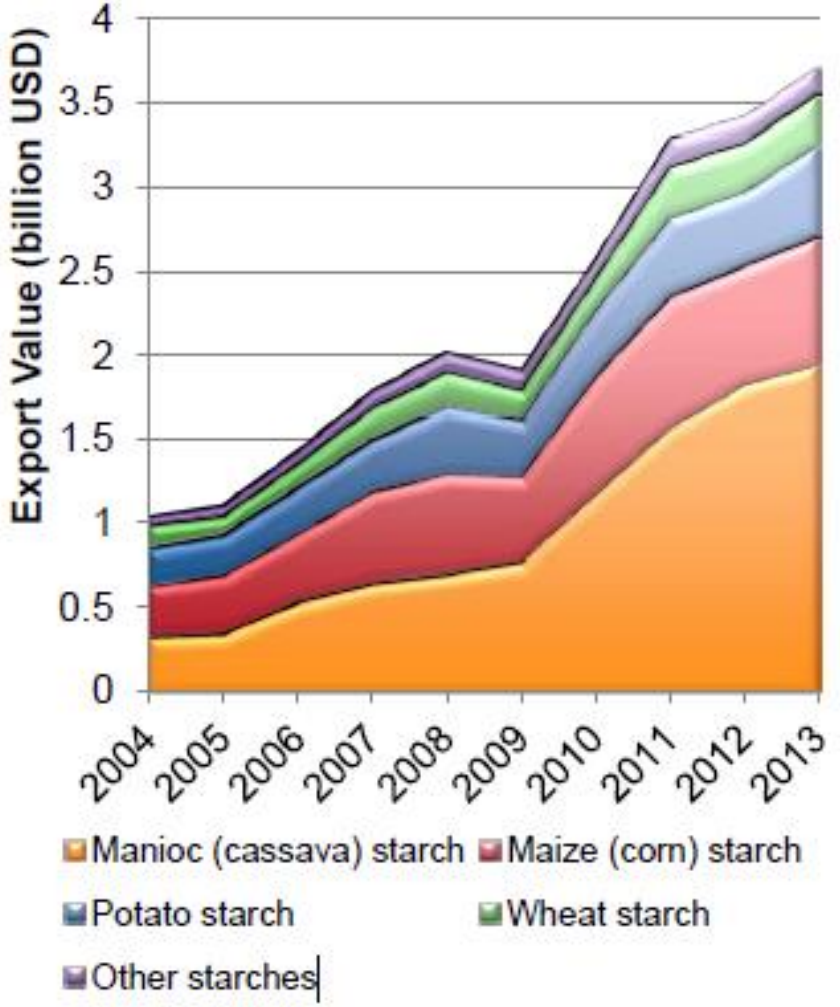
Starch – how important in the world?

- About 75m MT all types (equiv. annual production of rice, maize, beans and cassava in Colombia!)
- 60% maize; 10 % cassava
- Cassava is *most traded* starch
- Principal driver of cassava expansion in Asia in the past decade
- Most cassava starch from SE Asia; Paraguay *second largest* exporter

Cassava is by far the most traded starch
-- almost $2 billion annually --



What's the technology?

- A mutant in the granule bound starch synthase (GBSS) pathway ⟶ amylose-free (*waxy*) starch
- Trait also known in many other crops, e.g. maize, potato, rice
- Discovered in 2006 (AM206-5) after large-scale selfing in genebank
- Simple inheritance – easy to breed for
- Simple detection in segregating populations

Understanding the gene

- Gene structure under study
- Several sources identified after initial discovery
- Genetic variants from different sources of the granule bound starch synthase (GBSS) gene
- Appear to have same functional properties
- **Genetic variants can have implications for IP agreements**

Why does it have value?

Source	Storage stability (4°C)	Freeze/thaw stability (18°C)	Clarity	Taste
Maize	*	*	*	Cereal
Rice	***	*	*	Cereal
Potato	*	*	***	None
Cassava	***	**	**	None
Waxy maize	***	**	**	Cereal
Waxy Rice	***	***	*	Cereal
Waxy Potato	**	**	***	None
Waxy Cassava	***	***	***	**None**

• = low acceptability
** = medium acceptability
*** = high acceptability

Source: **Sánchez T., Dufour D., Moreno I. X., Ceballos H. (2010).** Comparison of Pasting and Gel Stabilities of Waxy and Normal Starches from Potato, Maize, and Rice with Those of a Novel Waxy Cassava Starch under Thermal, Chemical, and Mechanical Stress. ***Journal of agricultural and food chemistry***, **58**, 5093–5099. *http://dx.doi.org/10.1021/jf1001606*

*Clean La*bel Foods (Ingredion)

1. Free from chemical additives: remove or replace food chemical additives

2. Simple ingredient listing: choose consumer recognisable ingredients that do not sound chemical or artificial

3. Minimally processed: process foods using traditional techniques that are understood by consumers and not perceived as being artificial

Why does it have value for farmers?

"National Starch [Ingredion] believes it can assist farmers by creating demand for cassava starch needed for starch production. The demand thus created for specialty products based on cassava starch will, in the main, be additive to demand for conventional cassava. This additive demand is expected to be priced at a premium relative to conventional cassava, which may afford farmers a higher income per hectare planted."

Excerpted from the Cassava Starch Agreement between CIAT and National Starch [Ingredion], 2009

Why pursue a PPP instead of a standard public goods strategy?

- Development costs
- Sophistication of the value chain (only few large industries can manage, at least initially)
- Improved opportunities for farmer benefits
- Opportunity for longer term revenue flow

The kernel of the issue

An excerpt from a recent PPP agreement:

The exclusive commercialization agreement is a new concept for cassava, so it is not possible to fully predict the benefits for small vs medium or large holders. What is clear, however, is that globally, cassava is being transformed from a crop mainly for home and local consumption, to a crop of broad and diverse uses and markets.

Limits of our disclosure

“We have confidentiality agreements with companies and with consultants who have worked with us. This presentation will respect these agreements.”

Various contract options

Looking for win – win – win - win

(Farmers - CIAT - Partners – Companies)

2008 – 2013: Thai Tapioca Development Institute: Waxy varieties for Thailand

- *A straightforward contract between CIAT and TTDI to supply waxy cassava gene in segregating populations, and technical support*
- *No royalty payments on technology use*

2008 TTDI – CIAT Agreement

2012 TTDI harvest

WORLD'S FIRST NON-GMO WAXY CASSAVA VARIETIES

http://www.tapiocathai.org/

Various contract options

Looking for win – win – win - win

(Farmers - CIAT - Partners – Companies)

2008 – 2013: Thai Tapioca Development Institute: Waxy varieties for Thailand

2009 – 2013: Ingredion: Starch agreement (traits and fields of use); provide starch samples of increasing volume

2012 - 2013: Ingredion: Waxy semi-commercial level production -

2012 – 2018: Ingredion: Waxy varieties for north coast area of Colombia

2013 – 2019: Ingredion – Embrapa: Waxy varieties for Brazil NE & S)

Due diligence on IP value

Study by an IP valuation expert consultant (January 2012)

- Review of the technology
- Estimated value to industry for commercialization
- Estimated area under production
- Comparison of similar royalty rate transactions
- Proposed royalty rate for CIAT
- Recommendations on legal advice

Due diligence on IP value

- *. . . The best estimate of the current value for commercialization of waxy cassava starch to CIAT is $XXXXXXXXX. The total market for waxy cassava starch is estimated at $XXXXXXX million in sales in the first year of full-scale commercialization.*

- *. . . Based upon the comparable royalty rate transactions, a royalty of XXX% on net sales is assumed.*

Several contracts with Ingredion from 2009 - 2019

Are there genetic resources issues?

- The genebank accessions registered into the multi-lateral system of the International Treaty on Plant Genetic Resources for Food and Agriculture.
- First derivatives can be licensed out. The treaty includes direction on licensing in order to “achieve commercial benefit-sharing.”
- Treaty codifies the licensing expectations for sales of seeds, which is not the product in this case.

Does the agreement comply with CGIAR principles on development of public goods?

“Waxy-cassava per se is not the technology. The extracted starch serves as a product which will be modified by the party to serve special needs in the i.e. frozen food industry. The modification and application for a specific purpose is the technology. That party will patent the modification process so that the starch can deliver a competitive advantage in a value chain."

The unknowns or confidential information

What exactly does Ingredion intend to use it for?

What will be the expected volume of starch processed and sold?

What will be the price premium in the marketplace?

What will be the price premium for farmers?

What will be the basis for calculating the revenue stream from Ingredion?

How much will CIAT earn from this venture?

Will it work?

The evidence so far . . .

Agronomics

- Experimental yields close to better hybrids in Colombia
- Evidence of a very small drop in dry matter content (<1%)
- Unknown effects on traits like “seed” quality, pest and disease resistance, post-harvest deterioration

Commercial viability

- Ingredion remains highly optimistic

What next?

- Current conversations with 3 starch companies
- Other value-added traits with PPP potential?
  - Small granule starch
  - Hi amylose (resistant starch)
  - Herbicide resistance
  - Other

Summary of how the Cassava Program PPP's have developed

- The idea phase – a push/pull dynamic
- Protecting the ideas: a confidentiality agreement
- Establishing trust
- Valuing the product
- A proposition for sharing the benefits
- Due diligence on defining the beneficiaries
- Contract development
- Product development and impact pathway
- Monitoring and evaluation
- Collecting and reinvesting the benefits

Heroes' corner (a few of many)

Hernan Ceballos (CIAT)
Adul (TTDI)
G Arias (CIAT)
L A Becerra Lopez-Lavalle (CIAT)
F Calle (CIAT)
D Dufour (CIRAD)
R Echeveria (CIAT)
J Emling (Ingredion)
E Guimaraes (CIAT)
D Hanchett (Ingredion)
A Hubscher (CIAT)
M V Jaramillo (CIAT)
P Kittipadakul (Kasetsart U)
J Leighton (Ingredion)
J I Lenis (CIAT)
A Macia (Ingredion)
N Morante (CIAT)
X I Moreno (CIAT)
G Ortiz (Ingredion)
B Ostrander (Ingredion)
Chalermpol Phumichai (Kasetsart U)
Chareinsuk Rojanaridpiched (Kasetsart U)
Domingo Haroldo Reinhardt (EMBRAPA)
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